

CITY OF BONNER SPRINGS, KANSAS

**DIVISION V
DESIGN CRITERIA**

SECTION 5500 SANITARY SEWERS AND APPURTENANCES

APPROVED AND ADOPTED ON THE 11th DAY OF JULY, 2005
Revised December 7, 2012

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CITY OF BONNER SPRINGS, KANSAS

SECTION 5500 SANITARY SEWERS AND APPURTENANCES

SECTION 5501 GENERAL

5501.1 Introduction - These criteria cover design factors and provide guidelines for plan and specification evaluation by the City of Bonner Springs, Kansas. These criteria are not intended to cover extraordinary situations, and in such instances deviations from the criteria may be allowed where justified, upon the City's approval.

Sanitary sewer designs shall be sealed by a professional engineer licensed in Kansas. The designer shall submit such additional design information as required by the City. Design calculations, soil studies, and field survey data are examples of pertinent design information necessary for plan review.

Qualified construction observation is required. Unless otherwise provided, the designer shall perform this service.

Where the term "shall" is used in this document, it is intended to mean a mandatory requirement insofar as any confirmation by the City of Bonner Springs. Other terms like "should", "recommend" and "preferred" indicate discretionary use where the term "City" is used, it is intended to refer to the City of Bonner Springs, Kansas.

5501.2 Reviewing Authority Compliance:

A. Master Plans: The proposed design shall be in accordance with the City of Bonner Springs, Kansas master plans.

B. Other Requirements: It shall be the responsibility of the designer to comply with all standards and ordinances applicable to the project.

Applicable design standards include the most recent published edition of the following:

1. "Minimum Standards for Design of Sanitary Sewerage Facilities" of the Kansas Department of Health and Environment.
2. Joint publication WPCF MOP No. FD-5 and ASCE Manual No. 60 "Gravity Sanitary Design and Construction, 1982".
3. "Standard Specifications for State Road and Bridge Construction" of the Kansas Department of Transportation.
4. Applicable ASTM Standards

All designs shall meet the minimum required by these standards.

SECTION 5502 SUBMITTALS

5502.1 General: Proper preparation with timely and complete distribution are essential elements of the submittal process.

5502.2 Predesign Conference: A predesign conference with the reviewing authority, the design engineer, the developer where applicable, and representatives of the State regulatory agencies where appropriate, shall be conducted prior to any extensive design effort. A report or plan outlining the proposed project's scope and objectives shall be prepared and shall be made available prior to the conference. A primary consideration of the proposed project development is conformance to current sanitary sewer master plans and other adopted policies of the City.

The design engineer shall demonstrate an understanding of local sanitary sewer ordinances, sanitary sewer standard specifications and documents, sanitary sewer rights-of-way, easement policies (both public and private), and State standards for sanitary sewerage facilities.

A preliminary schedule indicating proposed dates for design submittals, construction drawings and specification reviews, construction bidding and award schedule, construction period, and conformance to construction records submittal shall be presented.

Included in the predesign conference will be discussion of sewer main material selection. It is City policy to install DIP or CRP as the preferred pipe material due to subsurface rock. Use of PVC and HDPE is acceptable when water main is to be installed in earth relatively free of rock. The City must concur with design engineer's material selection before Preliminary Design Memorandum will be accepted.

The design engineer shall be responsible for preparing pre-design conference minutes and furnishing a copy to all conference attendants within one week following the conference. The purpose is to provide mutual understanding and documentation for reference of principal matters covered at the conference. Proposed dates for furnishing the Preliminary Design Memorandum submittal and Final Design submittal and distribution shall be included in the conference minutes.

5502.3 Preliminary Design Memorandum:

- A. Purpose:** Prior to beginning final design work, the design engineer shall prepare a preliminary design memorandum and distribute it as agreed at the predesign conference for review and approval. The preliminary design memorandum shall be a condensed version of the final design submittal, but must contain sufficient detail to display adequate knowledge of the overall project requirements and scope.

The preliminary design memorandum's purpose is to establish a common understanding of project requirements and objectives through review comments, among all principal representatives involved. Decisions and agreements reached at the predesign conference as included in the conference minutes, shall be reflected in the preliminary design memorandum.

The preliminary design memorandum shall outline the project from concept through detailed implementation. It shall briefly present the proposed sanitary sewer project's purpose and scope and follow with a more detailed project description, including:

1. General location and information concerning the area to be served, including service area boundaries.
2. Relative location of the project to existing sanitary sewerage facilities within and adjacent to the proposed service area.
3. Review of planning studies to determine land use, population projections and other factors affecting wastewater discharge quantity and quality within the proposed service area.
4. Estimates of present and future design flows within the proposed service area, with consideration of facility expansion to serve upstream areas where applicable. (See Section 5503 Design Flows.)
5. Consideration of wastewater treatment from service area, in either existing or new facilities.

B. Facilities Requirements: Following an assessment of project area limits and sanitary sewerage service needs, the design engineer shall evaluate sanitary sewerage system facilities requirements to meet the present and future needs, including:

1. Review available information concerning service area topography, geology, subsurface soil types and ground water table elevation range and assess affects on project design, construction and operation.
2. Preliminary routing of proposed gravity sewers and lift station force mains where applicable.
3. Preliminary site selections for lift stations and site access where applicable
4. Preliminary sizing based on capacity requirements and available slope along proposed routes and additional capacity requirements based on overall master planning. (See Section 5504 Sewer Line Sizing).
5. Lift station sizing, including holding basins and other site development, and associated force main sizing. (See Section 5504 Sewer Line Sizing and Section 5507 Lift Stations.)
6. Proposed construction material alternates for sewer pipe, manholes, castings and other construction based on established City standards.
7. Determine temporary construction and permanent easement requirements and other site access needs.
8. Prepare location drawings showing proposed facilities on the current topographic map. The drawings shall be suitable for exhibit display.

9. Prepare preliminary opinion of project cost, including construction, engineering, fiscal, legal and administrative, with separate allowances for easements, rights-of-way, and lift station sites. The best information available, without appraisals, shall be used in preparing the cost estimate. A contingency should also be included.

C. Distribution: The design engineer shall make distribution of the preliminary design memorandum as established at the predesign conference. Reasonable time shall be allowed for comments on the preliminary design memorandum reviewing parties, with corresponding dates set for receipt of review comments and the final design submittal.

2502.4 Final Design Submittal: The final design submittal shall consist of construction drawings or plans, specifications and contract documents, adequate in detail and clarity for project bidding and construction. See sections 5000, 5001, and 5002

SECTION 5503 DESIGN FLOWS

5503.1 General: Sanitary sewers shall be designed to provide capacity for the anticipated maximum hourly quantity of sewage and industrial wastes, with approved allowance for infiltration and other extraneous flows. It should be noted that the infiltration and extraneous flow allowances vary widely within any given area, depending on a number of conditions. The values presented in this section are minimum general unit design flows. The design engineer should be cautious in the use of these values as a set rule since actual site conditions may cause variance from any value noted herein.

5503.2 Design Period:

- A. Collectors Sewers:** Sewers of the size up to and including a nominal diameter of eighteen (18) inches shall be designed for ultimate development using existing and/or projected land use for the estimated ultimate population of the area served.
- B. Larger Sewers:** Sewers with a nominal diameter of larger than eighteen (18) inches shall be designed for a minimum design period of not less than twenty five (25) years, using existing and/or projected land use. A longer design period shall be justified by a cost-effectiveness calculation using the "present worth" method.

5503.3 Design Flow Factors:

- A. General:** Sanitary sewers shall be designed to provide capacity for the anticipated maximum hourly quantity of wastewater (hourly peak flow), including appropriate allowance for infiltration and inflow. Actual measured flows shall be used whenever reliable wet and dry weather flow measurements are available.
- B. Capacity:** In the absence of actual measured flows, the following minimum hourly peak design flows by land use, shall be used (an infiltration/inflow allowance is included):

<u>Land Use</u>	<u>Minimum Peak Design Flow Rate (Cubic Feet per Second per Acre)</u>
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Residential Housing:

One and two family dwellings	0.0085
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Apartments: (actual density to be considered)

a. One through three story	0.018 cfs/ac
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b. Four-story and above	As directed by the City
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Commercial: (actual density and tenant types to be considered)

a. Small stores, offices, and miscellaneous businesses	0.010
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b. Strip Shopping Centers	0.015
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c. Regional Shopping Centers	0.015
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d. High rise	As directed by the City
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Industrial: (actual density to be considered)

a. Light	0.02
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b. Heavy	As directed by the City
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C. Limitations: These design factors shall apply to watersheds of 300 acres or less. Design factors for watersheds larger than 300 acres shall be as follows unless otherwise directed by the City.

<u>Area in Acres</u>	<u>Minimum Peak Design Flow Rate (Cubic Feet per Second per Acre)</u>
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301-500	0.017
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501-1,000	0.015
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1,100-3,000	0.015-0.010 with linear decrease based on watershed
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SECTION 5504 SEWER LINE SIZING

5504.1 Gravity Lines: All public sewer lines shall be at least 8 inches in diameter. The downstream sewer pipe shall have the same or larger nominal diameter as the upstream pipe, unless otherwise approved by the City. All public sewers shall be designed to have a mean velocity of not less than 2.0 feet per second when flowing full. The maximum mean velocity, when flowing full should be less than 10 feet per second. For maximum mean velocities greater than 10 feet per second, special consideration shall be given to protection against erosion. All public sewers 18” or less should be designed to flow at two-thirds full while larger sewers should be designed at three-fourths full. Line sizes must be approved by the City Engineer.

All velocity and flow calculations shall be by the Manning Formula using an applicable "n" value for the pipe material:

$$Q = A ((1.486/n) (R^{2/3}) (S^{1/2})) \text{ where:}$$

- Q = Discharge in cubic feet per second
- A = Cross section area of flow in square feet
- n = Roughness coefficient of 0.013
- R = Hydraulic radius (R = A/P) in feet
- S = Slope in feet per foot
- P = Wetted perimeter in feet

For straight sewer alignment between structures, the following minimum slopes shall be used. Subject to the approval of the City, these minimum slopes shall be steepened to account for additional energy losses when curved sewer alignment is used.

Sewer Size In Inches	Minimum Slope in Percent* n = .013
8	.400
10	.248
12	.194
14	.158
15	.145
16	.132
18	.114
21	.092
24	.077
27	.065
30	.057
33	.051
36	.045

*Exceptions to these minimum slopes may be made in the upper reaches of lateral sewers where minimum size pipes will flow only partially flow. For a low density residential area, a sewer serving less than thirty houses may have a minimum slope of 0.76 percent and a sewer serving less than ten houses may have a minimum slope of one percent.

The minimum acceptable grade for pipe will be 0.4%, regardless of material of construction, unless a variance is approved by KDHE.

All building sewer lines are governed by the local plumbing code.

5504.2 Inverted Siphons: Inverted siphons should have no less than two (2) barrels. Each barrel shall have a minimum pipe size of 6 inches. There should be no change of pipe diameter in the length of the barrel. Sufficient head shall be provided and pipe sizes selected to provide mean velocities of at least 3.0 feet per second for average flows. Each barrel should be sized to accommodate additional flow from the other barrel should this other barrel be removed from service for cleaning. The rising leg should have these maximum deflections above horizontal:

6-inch pipe	11.25°
8 to 12-inch pipe	22.50°
Greater than 12-inch pipe	45.00°

An air jumper pipeline may be constructed in conjunction with the sewage barrel(s). Provisions for dewatering the air jumper pipeline must be made when the air jumper pipeline is below the hydraulic grade line of the sewer.

5504.3 Force Mains: All force mains for public sewers shall have at least a 4-inch nominal diameter, except force mains with grinder pump installations may have a smaller size diameter when necessary to insure an adequate flushing velocity. Force mains shall have a velocity in excess of 2 feet per second at design average flow. Force mains should have normal operating velocity in suction lines between 2 feet per second and 8 feet per second and in discharge lines between 3 feet per second and 8 feet per second. Construction and pumping costs are factors that should be considered before selecting the size of the force main. Flat sections of force mains 100 feet or longer in length should not be installed on a zero slope.

SECTION 5505 SEWER ALIGNMENT AND LOCATION

5505.1 Gravity Lines:

- A. Straight Alignment:** All sewers shall be designed on straight alignment between manholes, unless otherwise directed or approved by the City.
- B. Curved Alignment:** Requires pre-approval by the Kansas Department of Health and Environment and are discouraged due to special maintenance requirements. Sewers with curvilinear alignment and gradient must be a minimum of 24 inches in diameter. The following limitations apply at a minimum:
 - a. The maximum allowable deflection in any pipe joint shall not exceed 80% of either the pipe manufacturer's maximum allowable deflection per joint or that allowed by the applicable ASTM Specification.
 - b. In no case will the radius be less than 150 feet.
 - c. Curved sewers in street right-of-way shall be concentric with the street horizontal alignment.

- d. The designer shall include in the plans supporting information for horizontal curvature as necessary for staking, construction and design consideration.

C. Location:

1. **General:** Sanitary sewer should be located within street or alley, or if necessary, in a permanent easement on private property. Imposed loading shall be considered in all locations. Manholes should be located outside of paved areas and not within water courses. Manholes should be offset from property lines a minimum of four (4) feet.

Not less than eight (8) feet of cover shall be provided over the top of the pipe in street and alley rights-of-way. In all other areas, not less than five (5) feet of cover shall be provided over the top of the pipe. Sanitary sewers shall be located deep enough to serve existing basements, proposed basements or the first floor of buildings with no basements.

2. **Easements:** Where public sanitary sewers are located outside of existing rights-of-way, a minimum permanent easement of fifteen (15) feet for sewer depth less than 10 feet, twenty (20) feet for sewer depths 10-20 feet, and thirty (30) feet for sewer depths greater than 20 feet. Necessary temporary construction easement shall be provided. In addition, provisions shall be made for access to maintain the entire sanitary sewer system. The types and sizes of equipment used for sewer maintenance shall be considered for both manhole location and access easements.

3. **Streams:**

- a. **Alignment:** Sewers crossing streams should be designed to cross the stream as nearly perpendicular to the stream flow as possible and shall be on a constant grade. Sewer systems shall be designed to minimize the number of stream crossings. Sewers adjacent to streams shall be located outside of the high bank line plus a minimum of two (2) times the depth of bury, and sufficiently removed to provide for future possible stream widening and to prevent siltation during construction.
- b. **Cover Depth:** The top of all sewers crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. All sewers crossing drainage ways shall be encased in concrete and shall have a minimum of five (5) feet of cover depth above encasement. Design Engineer shall determine if additional depth is required due to channel erosion.
- c. **Erosion Protection:** All stream crossings shall have adequate erosion protection material type, thickness, and dimensions detailed on the Construction Plans.
- d. **Structures:** Manholes or other structures shall be located as they do not interfere with the free discharge of flood flows of the stream as required by the agency governing the stream.
- e. **Materials:** Concrete encasement shall be a minimum of six (6) inches thick.
- f. **Agency Review:** The Corp of Engineers and/or Kansas Department of Agriculture MUST review and approve all stream and river crossings. COE has jurisdiction over all navigable waters to include the Kansas River and require a 7 foot separation below the waterway flow line and the pipe. All stream crossings that are open cut must have Department of Agriculture approval and will require 5 foot of cover between the pipe and the waterway flow line elevation. Department of Agriculture does not require a review if the crossing is designed with the 5 foot separation and is directionally drilled. Drilling should not begin or end within the immediate area of

the waterway to prevent erosion possibilities. Additional review time in the form of 3-6 months should be allowed for these agency reviews. KDHE does not submit plans and specs to these agencies but WILL require verification of approval of the design.

4. **Aerial Crossings:** All stream obstructions must have Department of Agriculture approval. Support shall be provided for all pipe joints used for aerial crossings. The support shall be designed to prevent frost heave, overturning, and settlement. Use of stainless steel fasters are a requirement for pipe connections to the piers.

Precautions against freezing, such as insulation and increased slope, shall be provided. Expansion jointing shall be provided between above-ground and below ground sewers.

The aerial crossing shall be located as not to interfere with the flow of the stream as required by the agency governing the stream.

Aerial crossings shall be designed using ductile iron pipe or concrete pressure pipe. Aerial crossings of force mains are not allowed.

5. **Utility Protection:**

- a. **Water Line:** A minimum horizontal distance of ten (10) feet shall be maintained between parallel water and sanitary sewer lines as measured from outside edge of pipe to outside edge of pipe. At points where sanitary sewers cross water mains with less than two (2) feet of vertical clearance, the sanitary sewers shall cross under the water main and shall be designed using ductile iron pipe for a minimum distance of 10 feet in each direction. The crossing shall be arranged so that the sewer joints will be equal distance and as far as possible from water main joints and service lines.

Water and sanitary sewer lines shall not be placed in the same trench or excavation

- b. **Water Works Structures:** While no general statement can be made to cover all conditions, it is generally recognized that sewers shall meet the requirements of the appropriate reviewing authority with respect to minimum distances from public water supply wells or other water supply sources and structures.
- c. **Gas, Electric, Telephone, Storm Sewers and Other Utility Lines:** A minimum horizontal distance of five (5) feet should be maintained between parallel sanitary sewer lines, storm sewers and utility lines other than water lines.

The vertical separation between storm sewers and sanitary sewers should be two (2) feet minimum. If tees and wyes are installed, they should be routed from under gas, electric, telephone, storm sewer and other utility lines

6. **Steep Grades:** Sewers on 15 percent slope or greater shall be anchored securely with concrete anchors or approved equal, where spaced as follows: not over 36 feet center to center for grades 15 percent to 35 percent; not over 24 feet center to center for grades 35 percent to 50 percent; and not over 16 feet center to center for grades 50 percent or greater.

5505.2 Force Mains: Force mains should be placed in the street or alley right-of-way or if necessary, in a permanent easement on private property.

Force mains shall be placed at least forty-two (42) inches below the finished ground and generally may follow the topography of the terrain but care should be taken to minimize the

need for air release vales by use of an alignment with a constant positive / negative slope. The location of force mains with respect to water mains and other utilities, arterial crossings, stream crossings and steep grades shall generally be the same as for gravity sewers except force mains must cross under water mains with a minimum of two (2) feet clear between the pipes. Force mains shall be designed with reaction blocking and/or restrained joints at bends to withstand pressure surges.

Force mains terminating into a gravity sewer system shall not be more than two (2) feet above the flow line of the receiving manhole and crown of manhole outlet should match crown of force main discharge. Forcemain discharge shall be directed toward manhole outlet. Under no circumstances will a discharge elevation more than two (2) feet above the flowline be acceptable. The interior surface of the receiving manhole shall be waterproofed per Section 2510.3.

At high points in the force main where air can accumulate air release valves shall be used to prevent air locking. Air relief valves used shall be suitable to handle sewage. Air relief valves shall be placed in manholes over the top of the force main and protected against freezing.

5505.3 New Development Building Services:

- A.** All sanitary sewers shall provide a connection (wye, tee, or stub) for each building site in new development. The connection shall be extended with a service line to the property line at the center of the building site. The connection shall be designed to provide a vertical angle of not less than thirty (30) and no more than forty-five (45) degrees to the horizontal centerline plane of the sanitary sewer. The service line location shall be marked with an eight foot 2 x 4 board, painted green. Service line stubs cannot be deeper than 12 feet. All stublines for Commercial (non-office) service connections shall not be less than six (6) inches in diameter. Service lines cannot be connected directly to a manhole.
- B.** In conformance with the applicable plumbing code, a minimum drop shall be provided of not less than 3.0 feet between the basement floor elevation and sanitary sewer flowline elevation at the point of service line connection. The minimum basement floor elevation which sanitary sewer service can be provided shall be indicated. Consideration shall be given in providing sufficient depth where extra long connections, deep building service connections, or other typical conditions may exist. Service line stubouts shall be referenced to the downstream manhole and the centerline of the sewer. Stubouts at angles other than 90° off of the sanitary sewer shall be referenced by providing the angle between the sewer line and the service line and distance along the service line stubout.

SECTION 5506 SEWER APPURTENANCES

5506.1 Manholes

- A. General:** Manholes shall conform to the standards of the governing agency.
- B. Manhole Casting:**
 - 1. Flooding:** When located in areas subject to inundation by flooding or sheet flow. unvented and bolted covers shall be provided.

- 2. **Internal Pressure:** When designed to function with internal pressure, unvented, gasketed and bolted covers shall be provided and rings shall be anchored to manhole walls.
 - 3. **Vandalism:** When located in areas where theft and vandalism are expected, bolted covers may be required.
 - 4. **Larger than 15-inch Diameter Sewers:** When the diameter of the manhole's outgoing sewer is at least 15-inches, bolted covers shall be provided.
- C. Inverts:** The difference in elevation between the invert of any incoming sewer and the invert of the outgoing sewer shall not exceed 24 inches except where required to match crowns. When a sewer joins a larger one, the crown of the smaller sewer shall not be lower than the crown of the larger. The drop through manholes shall be as tabulated below.

<u>Deflection Angle Range (degrees)</u>	<u>Drop Through Manhole (feet)</u>
0 to less than 10	None
10 to less than 45	0.2
45 and greater	0.4

- D. Drop Manholes:** Drop manholes should be avoided when possible. Freefall drop manholes shall not be used. Where drop manholes are used, they shall be outside drop manholes and the incoming flow shall be piped to the manhole invert. Inside drop manholes may be used with existing manholes with City approval. See Standard Detail 25-11.
- E. Diameters:** The minimum horizontal clear distance within the barrel of manholes shall be 48-inches. Inside drop manholes require a minimum of 60-inches of clearance.
- F. Cleanouts and Lampholes:** The use of cleanouts and lampholes is prohibited.
- G. Manhole Location:** Manholes shall be installed at the end of each line, changes in pipes size, grade at intersections and at changes in alignment. The preferred distances between manholes is 350 feet and shall not be greater than 400 feet for sewers 18" and smaller, and 500 feet for sewers larger than 18". When a sewer is located in an easement not abutting a street or alley right-of-way, access shall be provided to all manholes. Manholes cannot be located in driveways or sidewalks. The preferred location is centered horizontally within the building lots.
- H. Manholes Receiving Force-mains:** See Section 5505.2.

5506.2 Air and Vacuum Relief Valves: Air relief and vacuum relief valves shall be provided in the lift station discharge piping and forcemain to adequately vent air and gas and to allow entrance of air as required. Air relief valves shall be sized to prevent line entrapped gas blockage. Vacuum relief valves shall be sized to protect the discharge pipe from collapsing.

SECTION 5507 LIFT STATIONS

5507.1 General

- A.** Lift stations are pumping facilities which are used to convey wastewater from a point beyond which gravity flow is not practical.

- B.** All lift stations shall have at least two pumps with the size and number of pumps such that the rated capacity of the lift station can be met with the largest pump out of service.
- C.** The cycle of operation for pumps will not be less than five (5) minutes, with maximum number of starts per pump per hour not to exceed that recommended by the pump motor manufacturer. One pump start per station per hour is required.
- D.** Unless designing a grinder pump lift station, lift station pumps shall be capable of passing a 3-inch diameter sphere.
- E.** All equipment in the lift station wet well and that equipment which can be exposed to gases from the wet well shall conform to the National Electric Code Class 1, Group D, Division 1.

5507.2 Types: Acceptable types of wet well lift stations are as follows:

A. Wet Well:

- 1. Submersible pump and motor.
- 2. Wet well centrifugal with motor located above the wet well.

5507.3 Layout and Siting:

- A.** Lift stations shall be located on public properties or on easements allowing for construction and access for maintenance of lift station structures, piping, valves, electrical service and all other required appurtenances.
- B.** Lift station sites shall be fenced to adequately protect the lift station equipment. Chain-link fencing shall include slats to screen station from public view.
- C.** All weather vehicular access shall be provided to lift station sites. Adequate vehicular turnaround shall be provided. Lift station structures and equipment shall be suitably protected from vehicular damage.
- D.** To allow for maintenance, access shall be available to all mechanical equipment. Means of access shall meet all applicable requirements of the latest edition of applicable OSHA regulations. Access doors and hatches to lift station structures and control panels shall be equipped with lockable features.
- E.** For submersible type lift stations, except the small grinder type, a valve vault adjacent to the wet well shall be used to accommodate the appropriate valve system and other pertinent appurtenances. Accumulated water shall be drained to the wet well while protecting against sewage entering the valve pit during surcharged wet well conditions.
- F.** Unless otherwise approved by the City, wet well and valve vault structures shall be reinforced concrete with appropriate water stops, where applicable.
- G.** Wet wells and valve vaults shall be vented with vent openings which prevent entrance by birds, small animals, and rain. Wet well vents shall be equipped with odor control facilities where required. Wet wells may be ventilated continuously or intermittently. Wet wells shall be ventilated at the rate of at least 12 air changes per hour if vented continuously and at the rate of at least 30 air changes per hour if vented intermittently.
- I.** Allowance shall be made for removal of all equipment and piping through access openings.

- J. Adequate space shall be provided around piping and equipment located inside structures such that personnel can perform all tasks as required for maintenance, removal and replacement of equipment.
- K. A hoisting system for maintenance of the lift station shall be provided when an alternate means for equipment removal is not available.
- L. Lift station structures and equipment shall remain fully operational and accessible during the 25-year flood. Lift station structures and electrical and mechanical equipment shall be protected from damage by the 100-year flood. The flooding elevation of the lift station structure and any electrical or mechanical equipment shall be a minimum of two (2) feet above the 100-year flood elevation.
- M. Gravity influent lines to the wet well must be 6-inches above high level alarm.

5507.4 Emergency Power:

- A. Provision for continued operation during power outages shall be made and based on protection of property safety considerations and the most cost effective alternative which affords the protection acceptable to the City.
- B. A standby power generator shall provide power for the starting and operation of one pump as well as lights, ventilating, and other auxiliary equipment necessary for safe and proper operation of the lift station. The emergency power supply need not be required to operate the standby pump if it is demonstrated to the satisfaction of the City that this is justified. This justification shall take into consideration the maximum anticipated flows relative to firm pumping capacity, anticipated length of power outages, and storage capacity.
- C. With City's approval, small lift stations may be equipped with a generator receptacle to receive power from a portable generator. The wet well and collection system shall provide adequate wastewater storage to allow time for detection of power failure, transportation, and set up of portable generator.
- D. Transfer from normal power to emergency or alternate power may be accomplished automatically or manually. When manually transferred, adequate storage of wastewater shall be provided to allow time for the transfer to be completed.

5507.5 Monitoring and Control:

- A. All monitoring and control equipment shall be located outside of the wet well.
- B. At a minimum, an alarm system shall be provided which activate in the event of any of the following:
 1. Power failure
 2. Pump failure
 3. Use of a standby or lag pump
 4. High wet well level
 5. Unauthorized Entry

- C. The City operates and maintains a radio telemetry system for transmission of alarm signals; all equipment provided shall be compatible and communicate with the existing system. The telemetry system shall transmit “remote” alarm signals to locations determined by the City. Lift stations utilizing a telemetry system shall, at a minimum, provide a “local” visual alarm. The requirement of a telemetry system may be omitted by the City on a case by case basis for small lift stations. Small lift stations without telemetry communications shall have both “local” audio and visual alarms.

Telemetry system must be approved by City prior to purchase and installation.

- D. Wet well level and pump operation shall use City approved ultra sonic measuring devices to determine liquid level in the wet well.

5507.6 Appurtenances:

- A. The proper type of isolation valves shall be provided in the discharge piping of each pump after the check valve. Isolation valves shall not be located in the wet well.
- B. Check valves shall be provided in the discharge piping of each pump, located between the pump and the isolation valve and not located in the pump wet well. Check valves shall be the swing or ball check type. Ball check valves shall not be used where valve manufacturer’s requirements for head or static pressure is not available to properly seat the ball. Swing type check valves shall be the outside weighted lever type and shall be horizontally mounted.
- C. Surge protection facilities shall be provided as required to protect the force main and lift station from surge conditions.
- D. A sump pump or other suitable means shall be provided to remove water or sewage from the valve vault.
- E. Corrosion of underground surfaces shall be minimized through use of passive or active cathodic protection systems, use of appropriate coatings or use of other acceptable means.
- F. A riser from the force main with a quick connection coupling and appropriate valving shall be provided in the valve vault to hook up to a portable pump. Sufficient storage capacity shall be incorporated in the design to allow time for detection of pump failure, transportation, and hook up of portable pump equipment.
- G. Exterior concrete surfaces shall have a bituminous coating. All interior concrete surfaces exposed to wastewater and acidic gases shall have a protective coating suitable for corrosive environment.

END OF SECTION